

FIG. 1

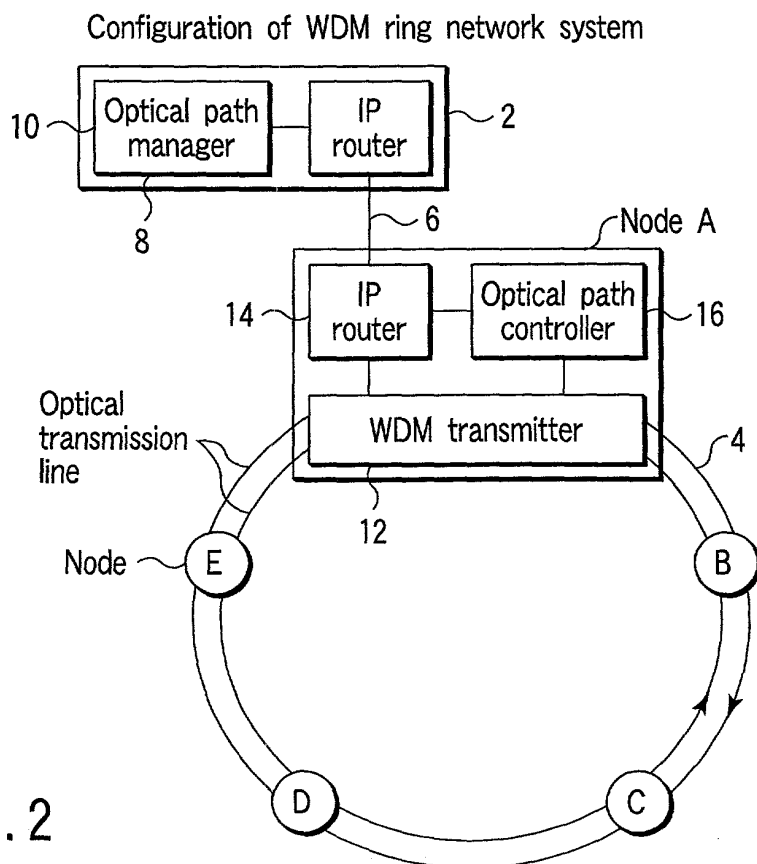


FIG. 2

20220726 16:46:00T 10079497.032202

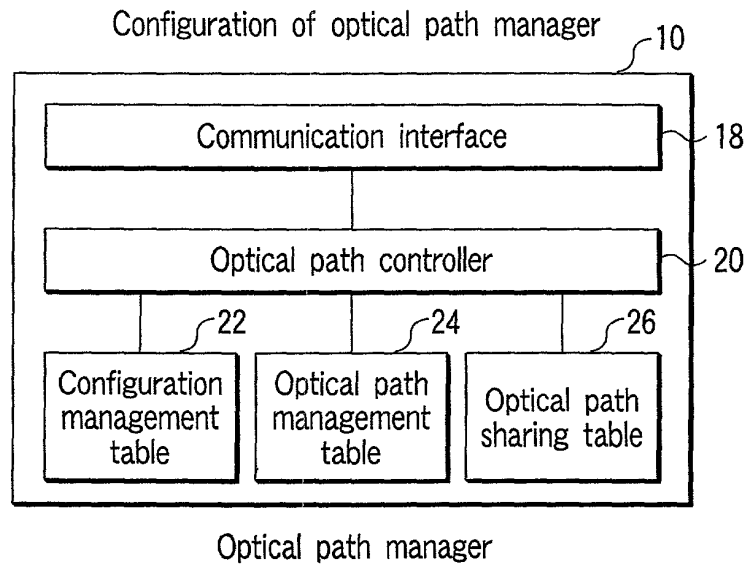


FIG. 3

Configuration management table

28 Node identifier	30 IP address of optical path controller	32 Inter-node connection relationship	34 Number of unused wavelengths owned by WDM transmitter
⋮	⋮	⋮	⋮

FIG. 4

Optical path management table

36 Optical path identifier	38 NID on route of optical path from start node to end node
⋮	⋮

FIG. 5

20220726 10:22:09 10079497.02209

Sharing table

40 NID	42 OID	44 Identifier (GID) when spare optical paths are grouped
⋮	⋮	⋮

FIG. 6

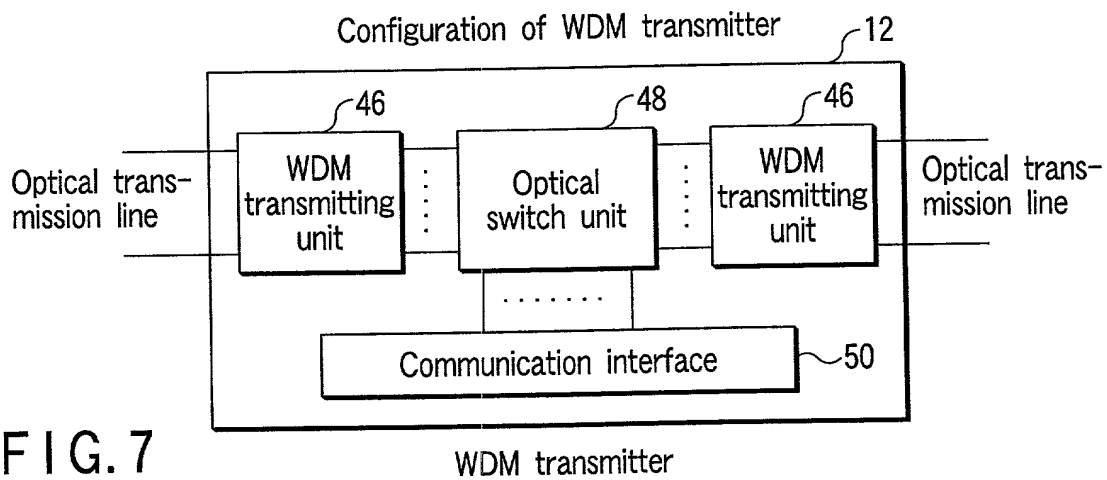


FIG. 7

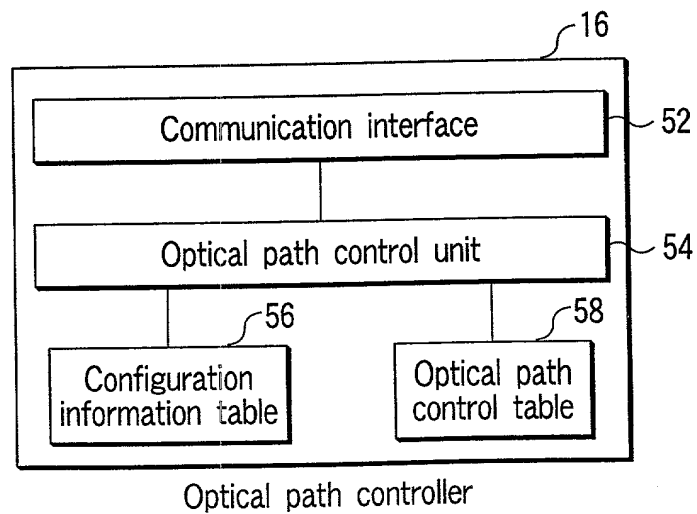


FIG. 8

(Setting request 1)

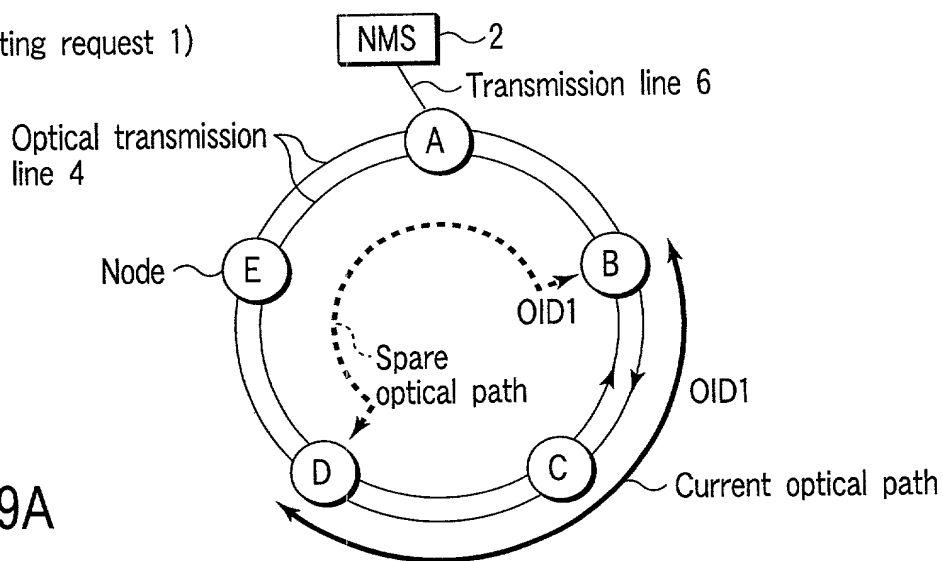


FIG. 9A

(Setting request 2)

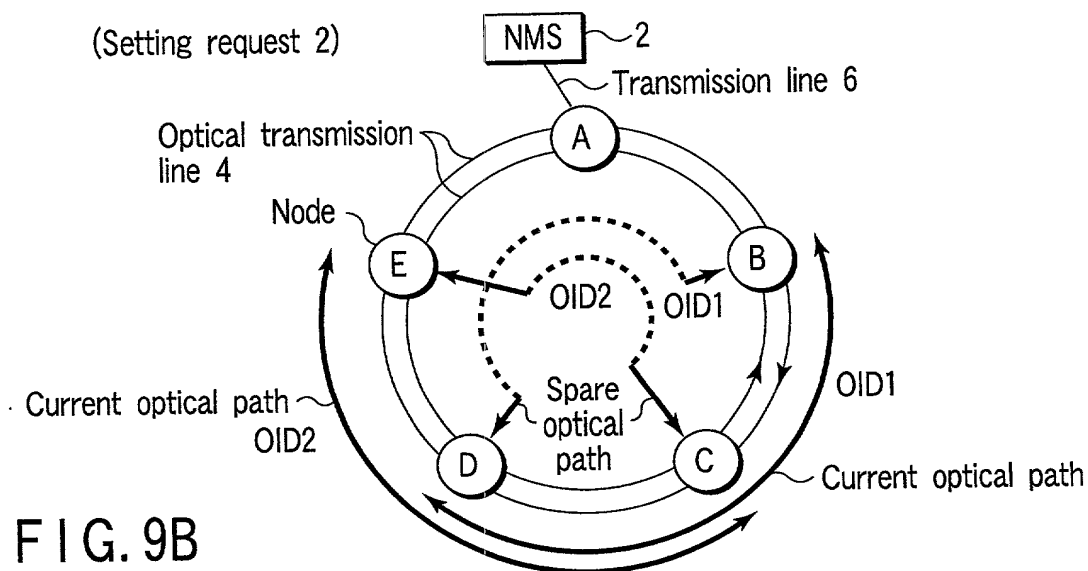


FIG. 9B

(Setting request 3)

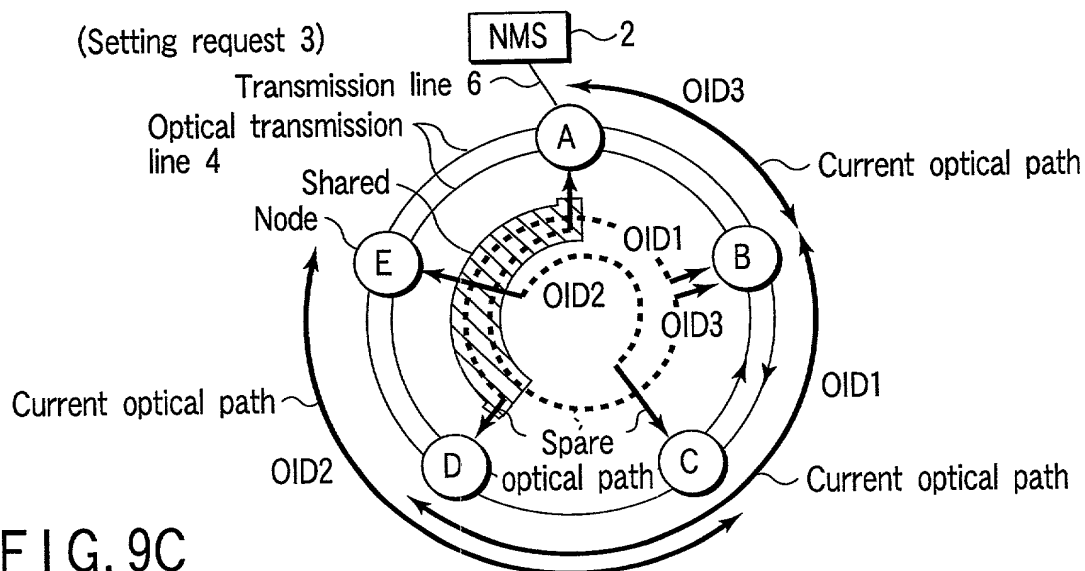


FIG. 9C

Flow chart showing NMS operation related to optical path allocation

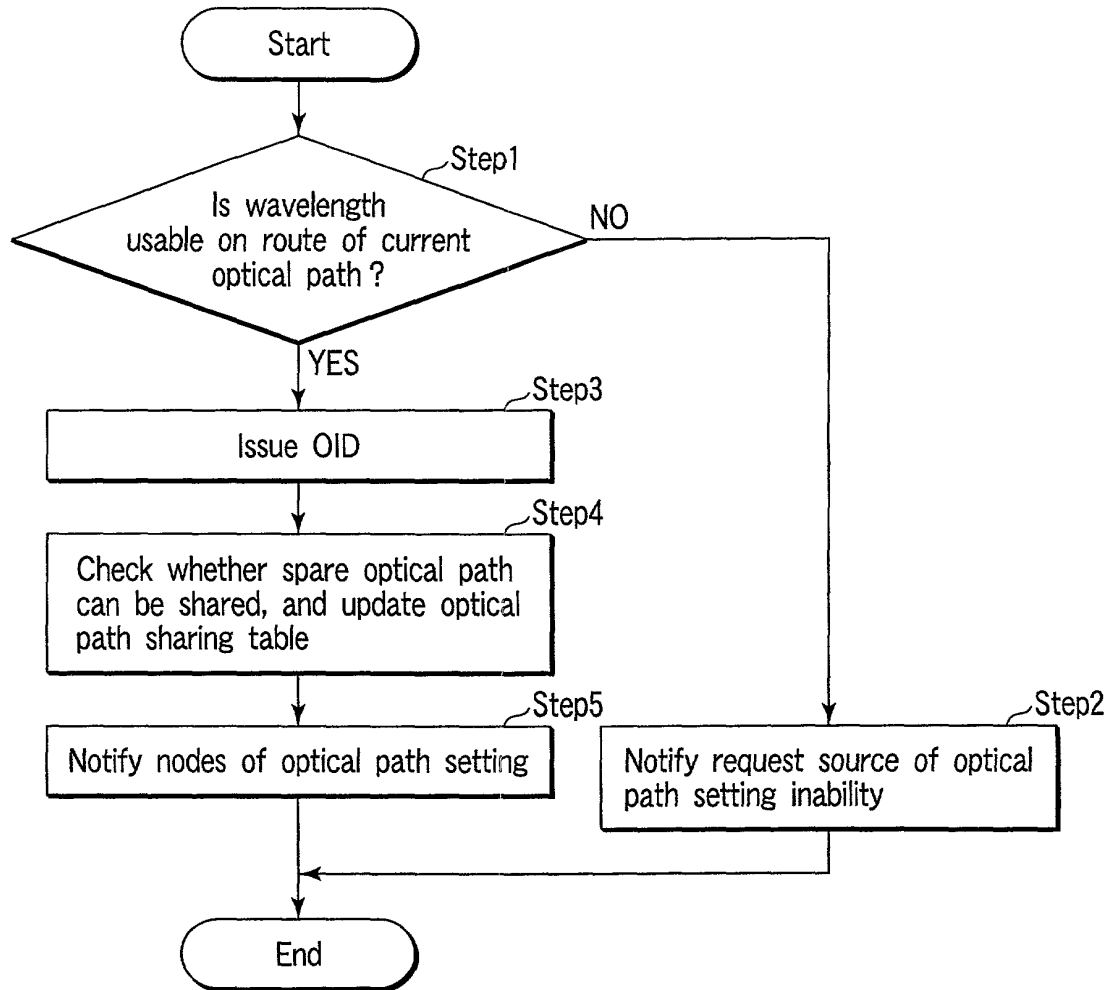


FIG. 10

Flow chart showing details of operation in Step4

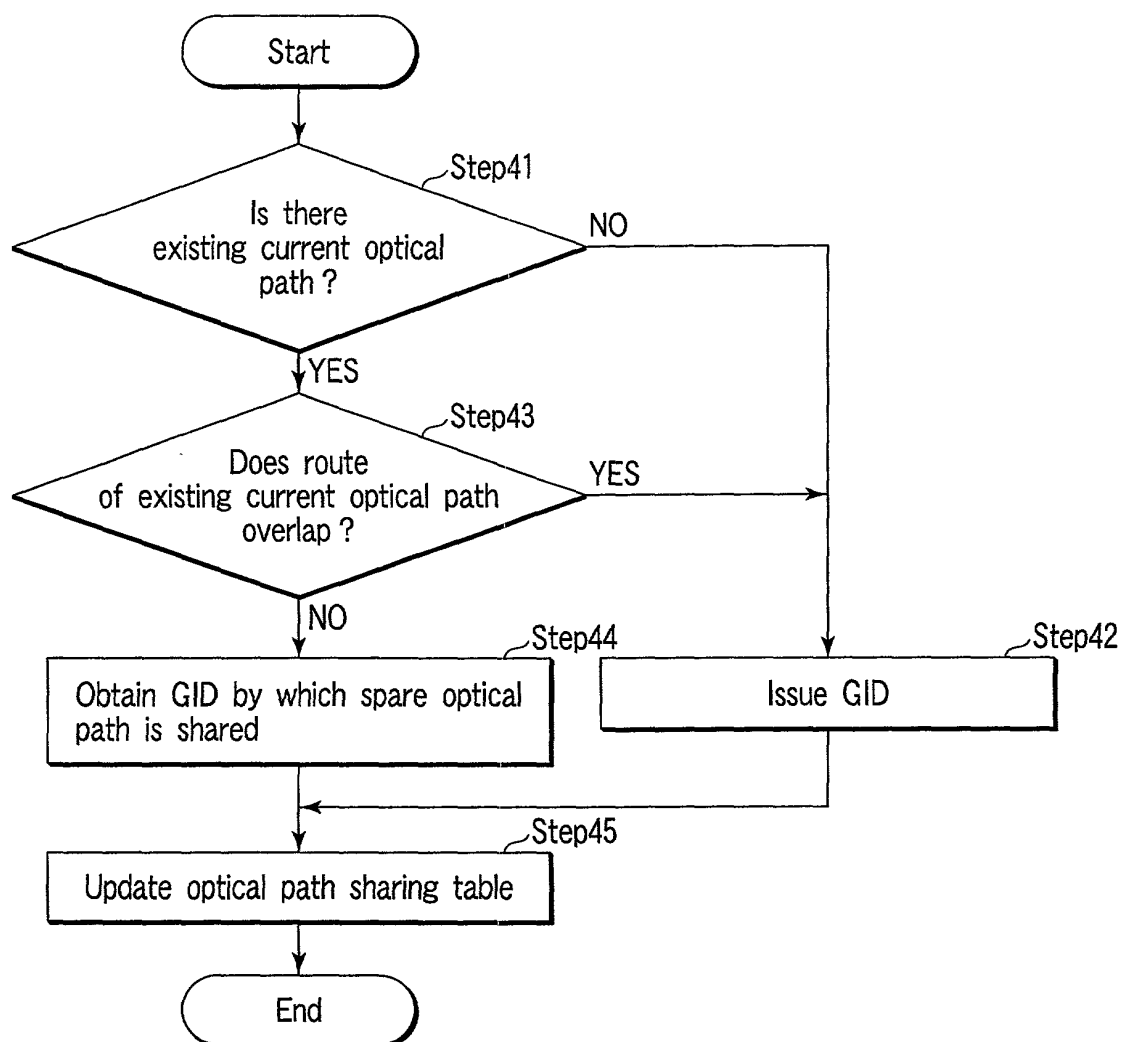


FIG. 11

Optical path sharing table

(Setting request 1)

GID \ NID	A	B	C	D	E
1		OID1	OID1		
2					
⋮					

FIG. 12A

(Setting request 2)

GID \ NID	A	B	C	D	E
1		OID1	OID1		
2			OID2	OID2	
⋮					

FIG. 12B

(Setting request 3)

GID \ NID	A	B	C	D	E
1	OID3	OID1	OID1		
2			OID2	OID2	
⋮					

FIG. 12C

Format of optical path information

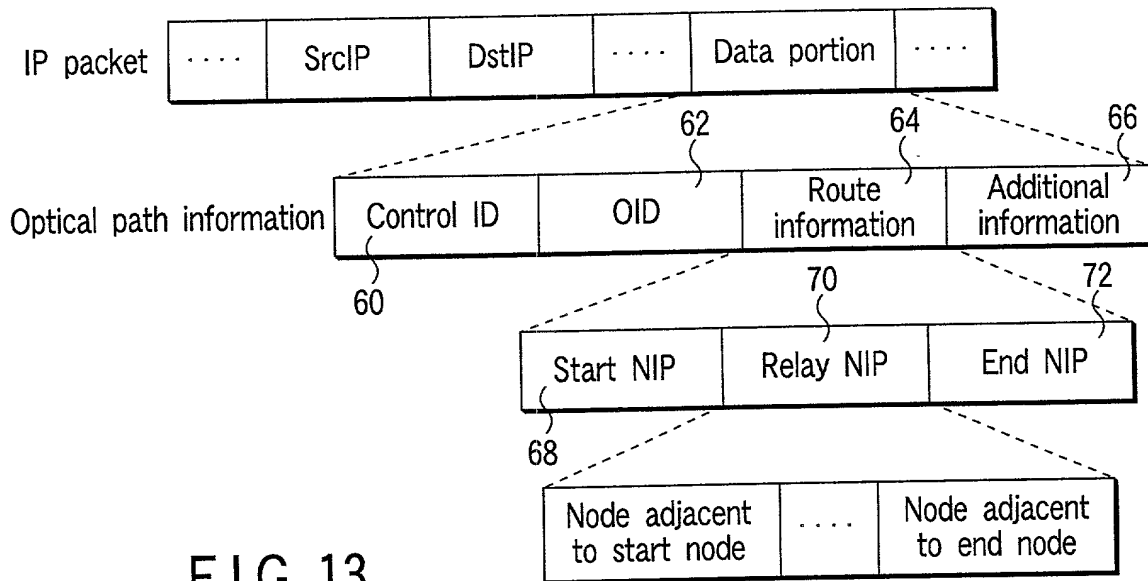


FIG. 13

Optical path information pertaining to optical path allocation

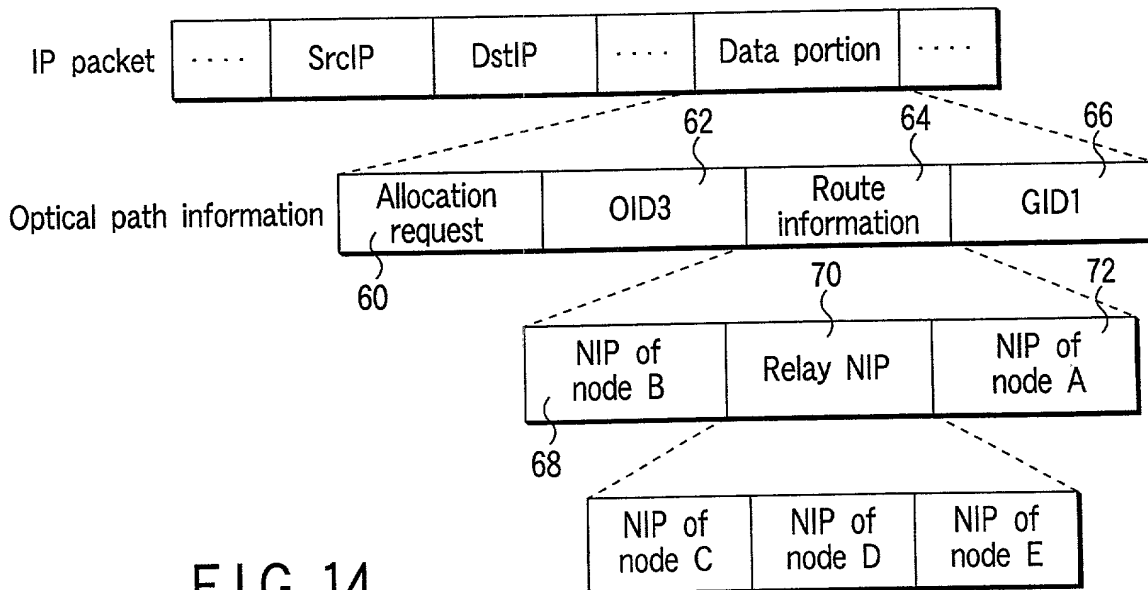


FIG. 14

Optical path control tables
(states immediately before spare optical path of OID3 is allocated)

Node A

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	in	1	1	out	1	1
2	in	2	2	out	2	2
3				add	3	

FIG. 15A

Node B

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	drop	1	1	add	1	
2	in	2	2	out	2	2
3	drop	3				

FIG. 15B

Node C

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	in	1		out	1	
2	drop	2	2	add	2	
3						

FIG. 15C

Node D

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	drop	1		add	1	1
2	in	2		out	2	
3						

FIG. 15D

Node E

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	in	1	1	out	1	1
2	drop	2		add	2	2
3						

FIG. 15E

Flow chart showing operation of optical path controller
(when allocation request is received)

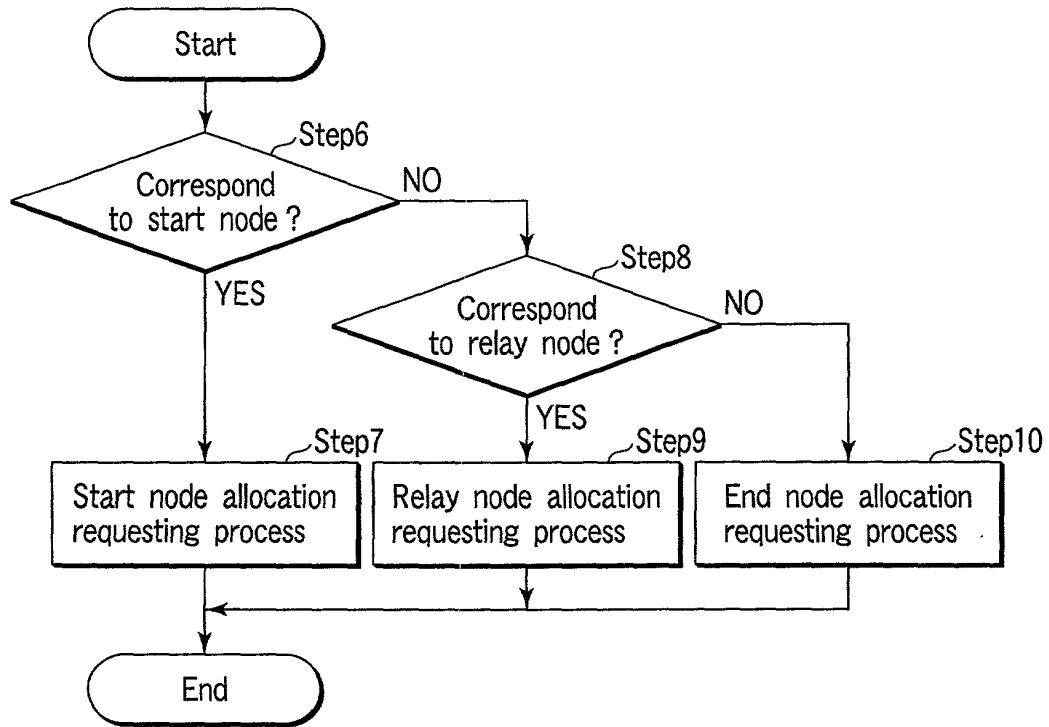


FIG. 16

Flow chart showing details of operation in Step7

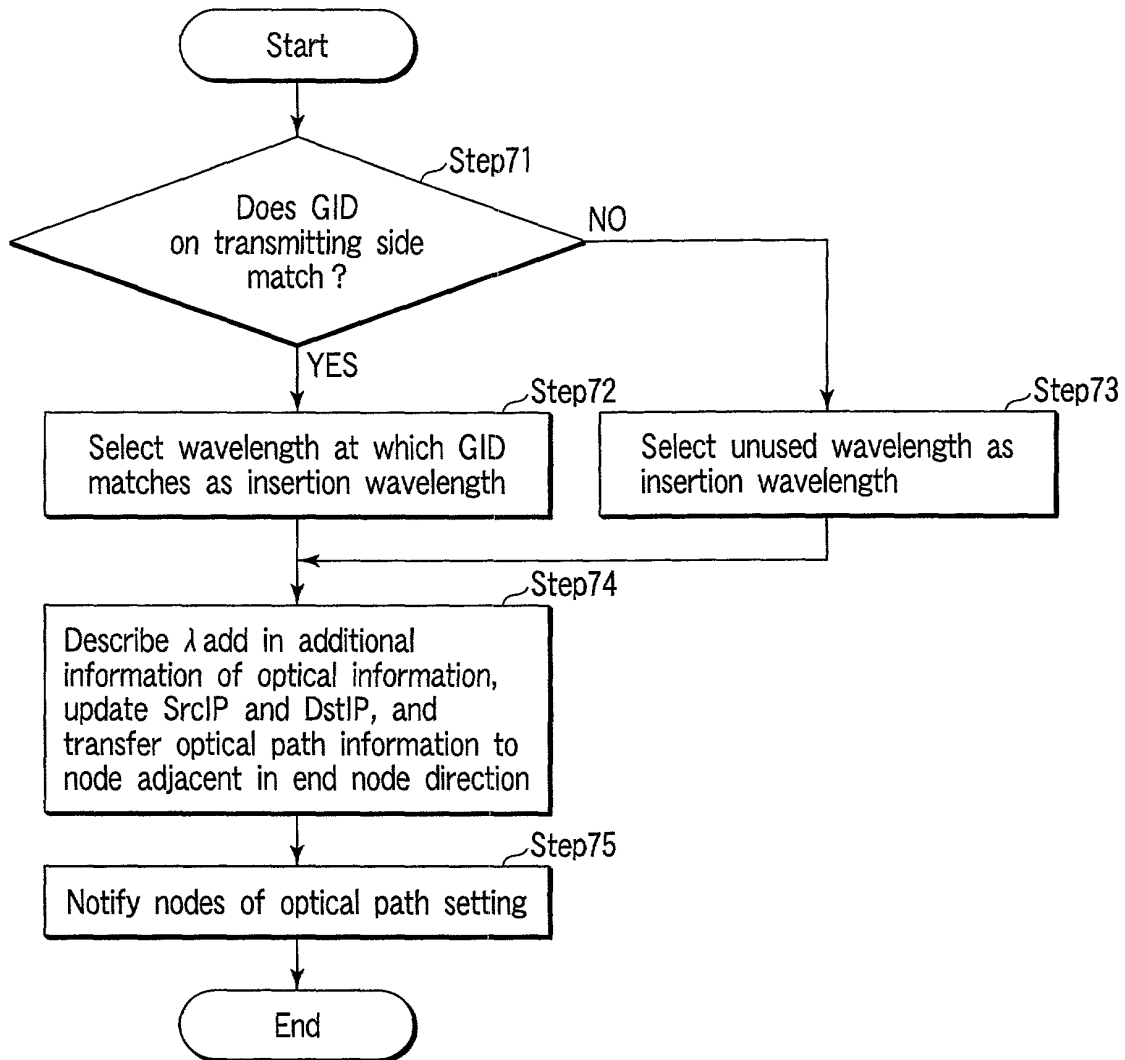


FIG. 17

Flow chart showing details of operation in Step9

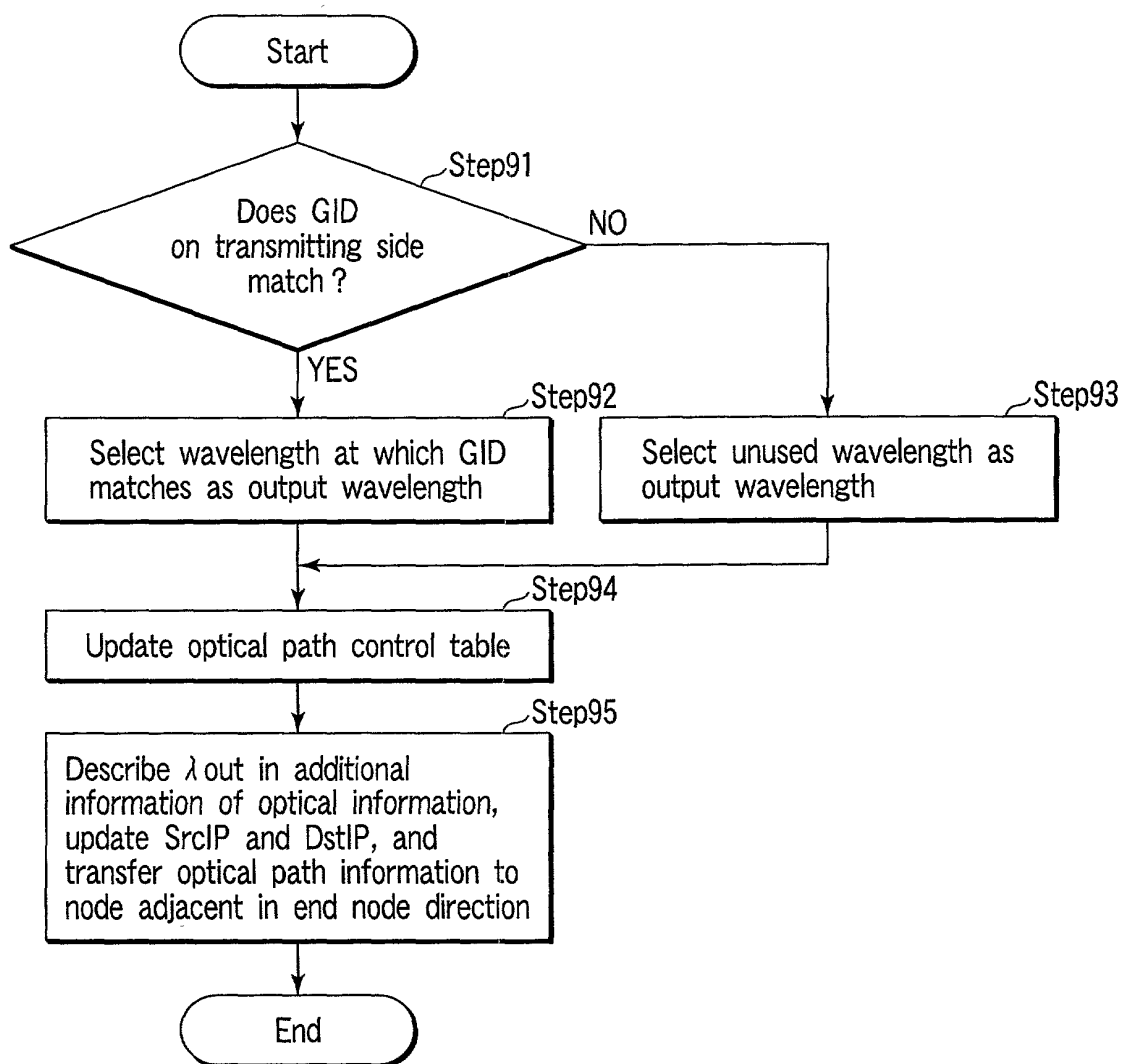


FIG. 18

Flow chart showing details of operation in Step10

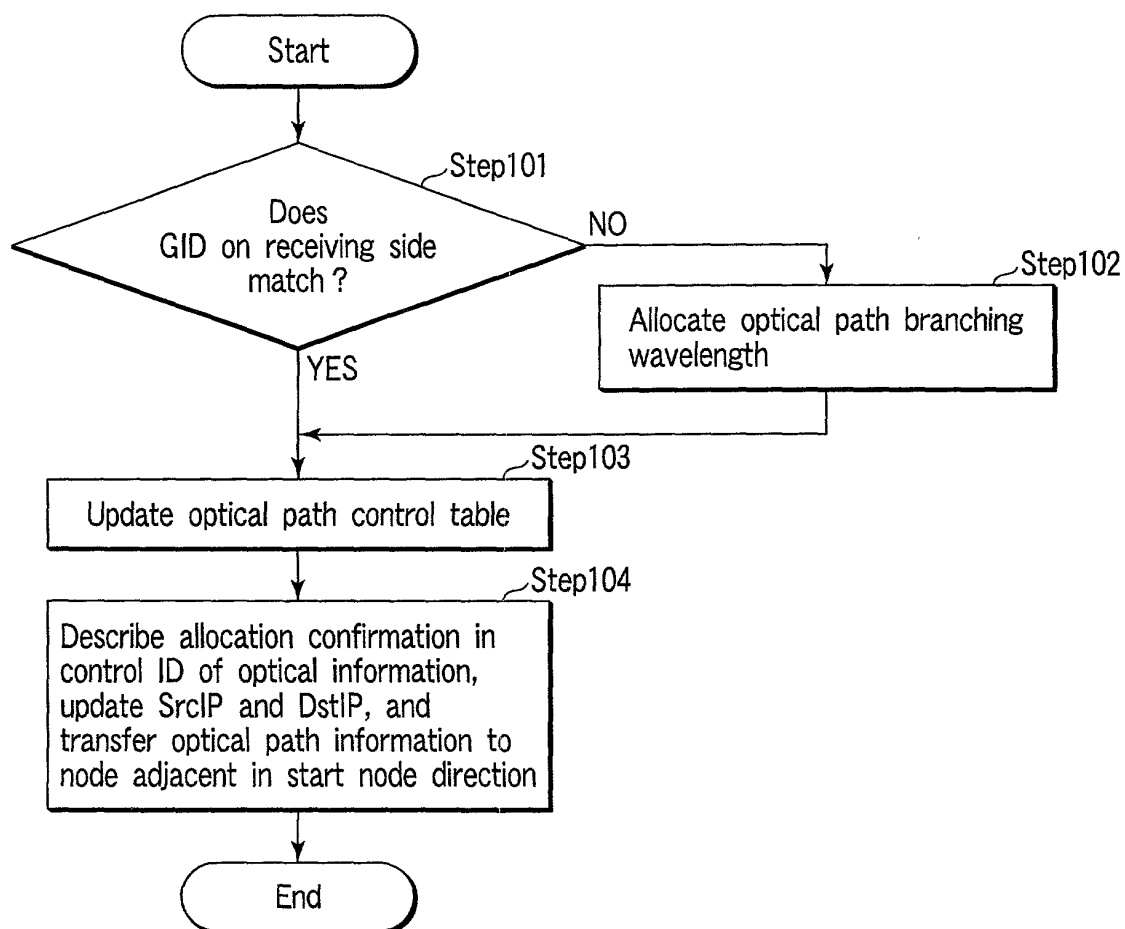


FIG. 19

Flow chart showing operation of optical path controller
(when allocation request is received)

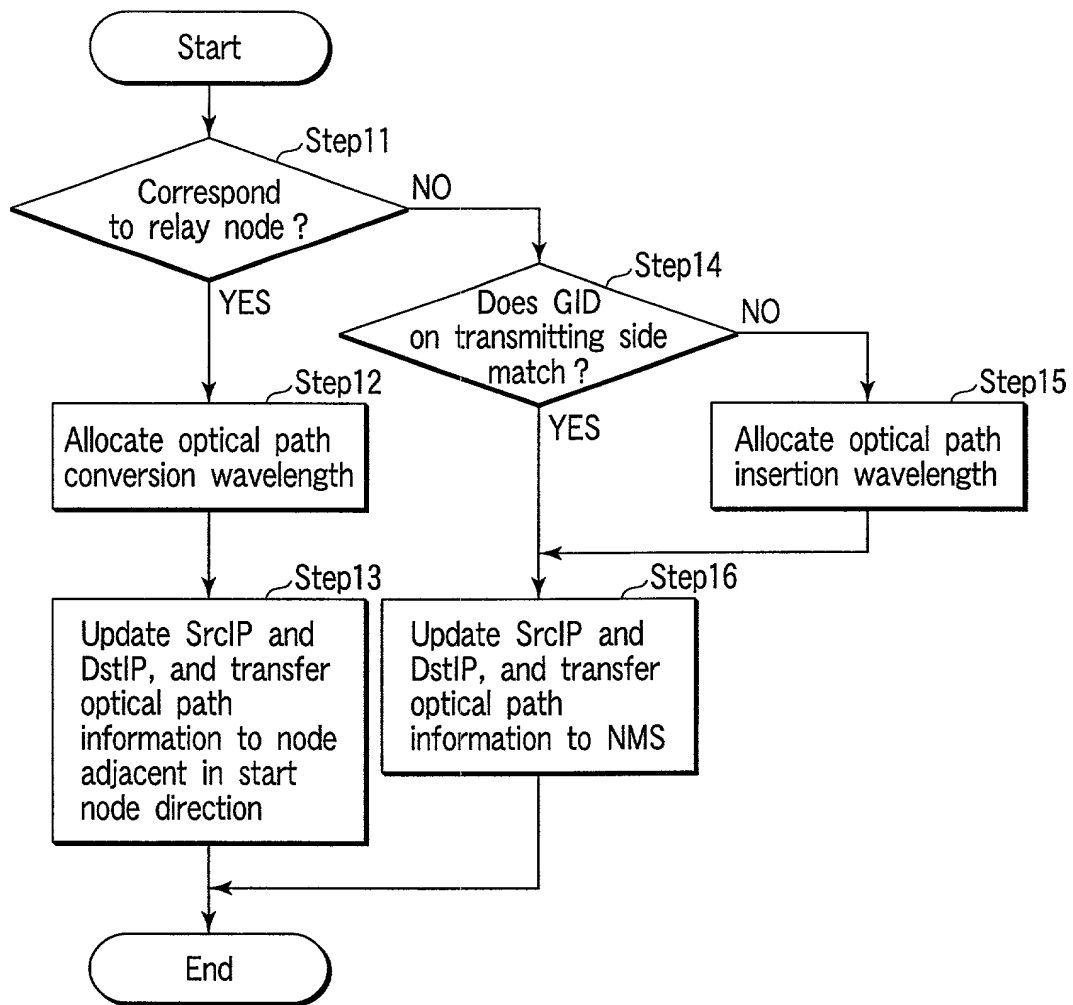


FIG. 20

Optical path control tables
(states immediately after spare optical path of OID3 is allocated)

Node A

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	in	1	1	out	1	1
	drop	3				
2	in	2	2	out	2	2
3				add	3	

FIG. 21A

Node B

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	drop	1	1	add	1	
2	in	2	2	out	2	2
3	drop	3		add	3	3

FIG. 21B

Node C

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	in	1		out	1	
2	drop	2	2	add	2	
3	in	3	1	out	3	1

FIG. 21C

Node D

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	drop	1		add	1	1
				out	3	
2	in	2		out	2	
3	in	3	1			

FIG. 21D

Node E

Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	in	1	1	out	1	1
		3			3	
2	drop	2		add	2	2
3						

FIG. 21E

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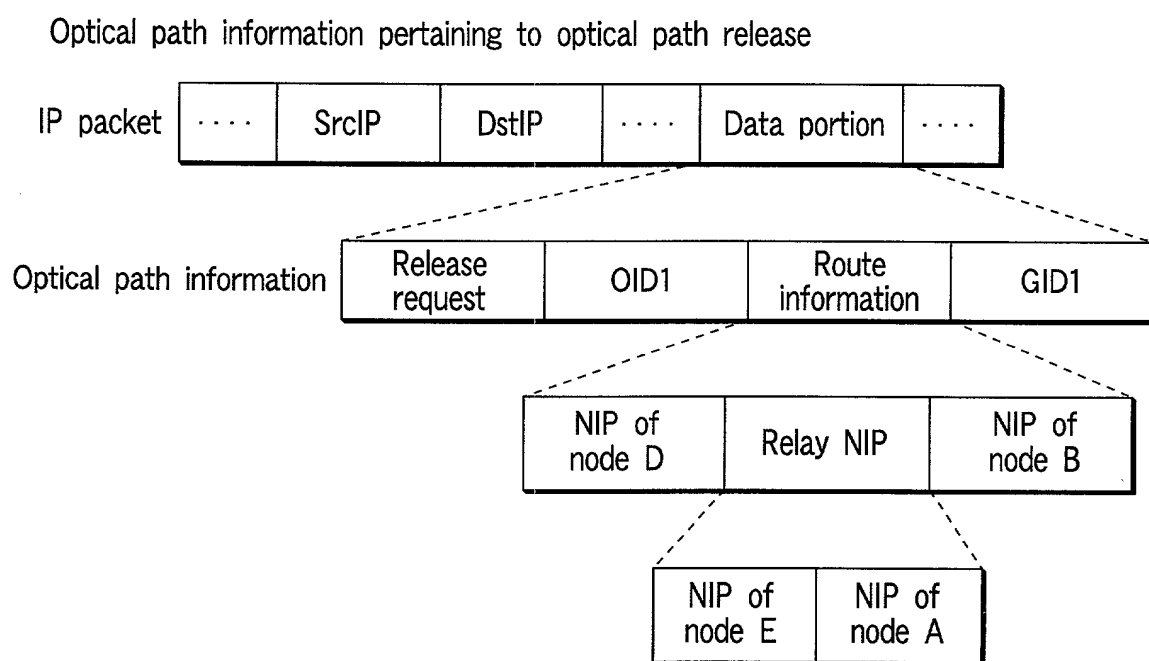


FIG. 22

Flow chart showing operation of optical path controller
(when release request is received)

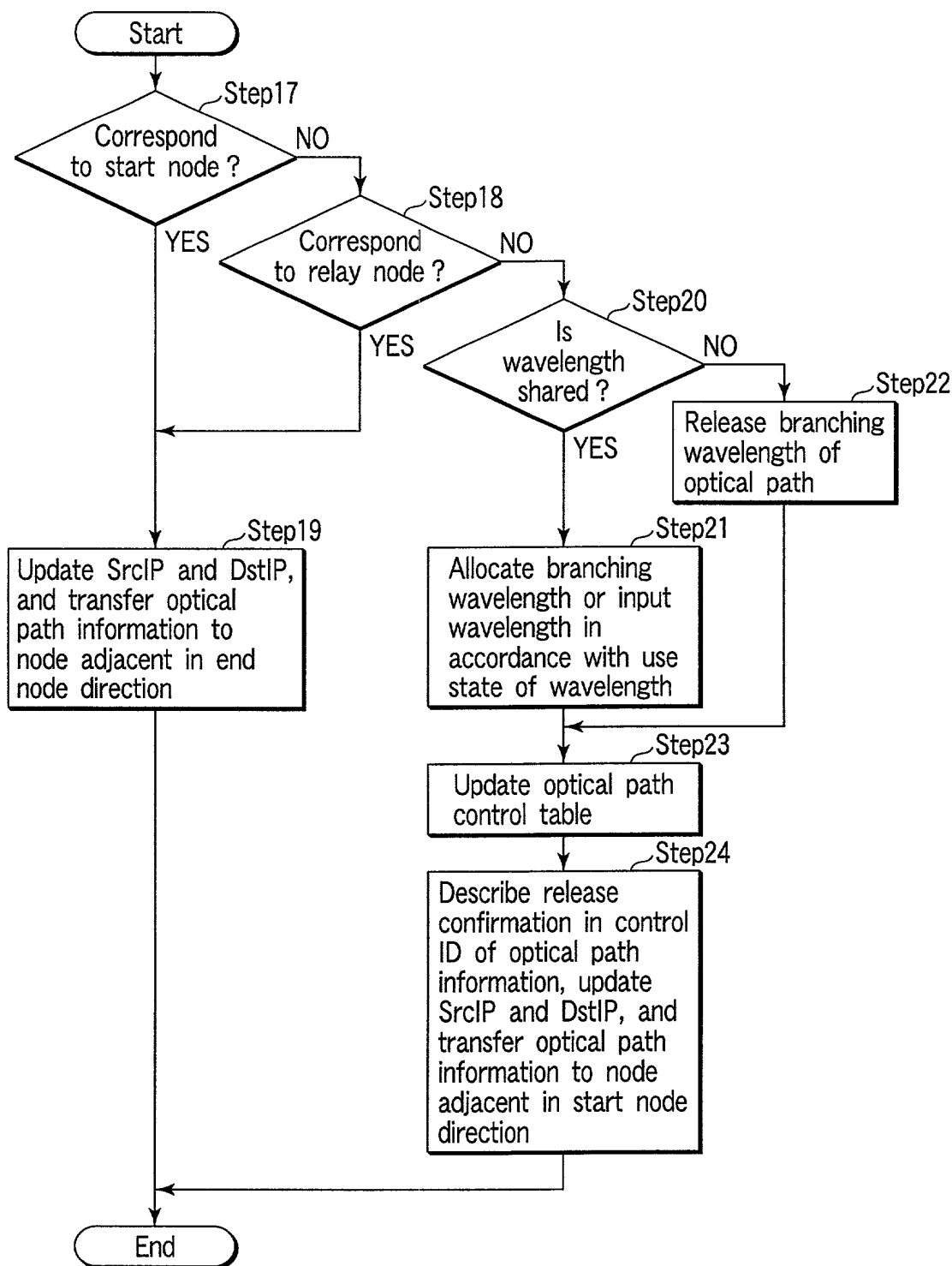


FIG. 23

Flow chart showing operation of optical path controller
(when release confirmation is received)

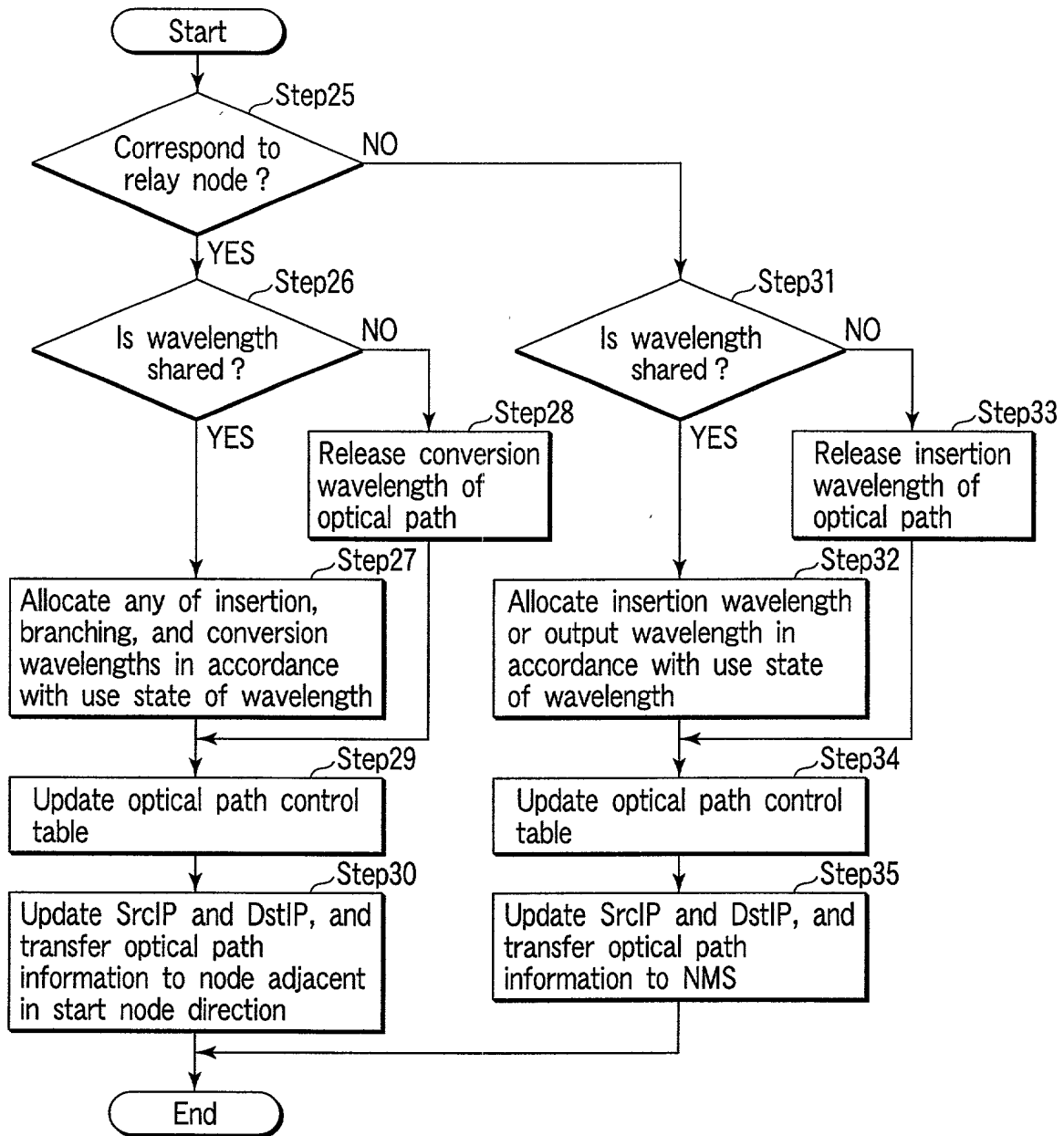


FIG. 24

FIG. 25A

Node A						
Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	drop	3	1			
2	in	2	2	out	2	2
3				add	3	

FIG. 25B

Node B						
Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1						
2	in	2	2	out	2	2
3	drop	3				

FIG. 25C

Node C						
Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1						
2	drop	2	2	add	2	
3	in	3	1	out	3	1

FIG. 25D

Node D						
Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1				out	3	1
2	in	2		out	2	
3	in	3	1			

FIG. 25E

Node E						
Wave-length λ	Receiving side			Transmitting side		
	Use state	OID	GID	Use state	OID	GID
1	in	3	1	out	3	1
2	drop	2		add	2	2
3						

Blocking probability of optical path setting

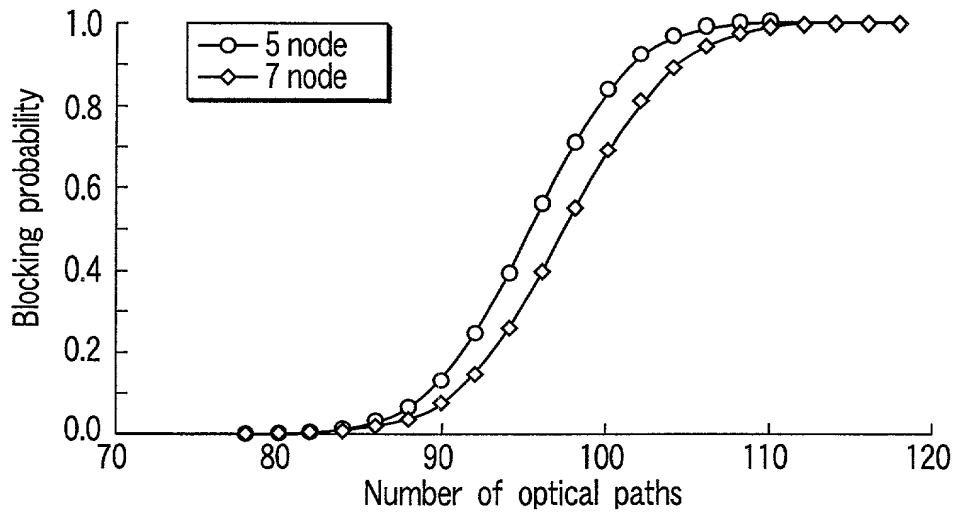


FIG. 26

Number of accommodated optical paths when number of wavelengths is changed

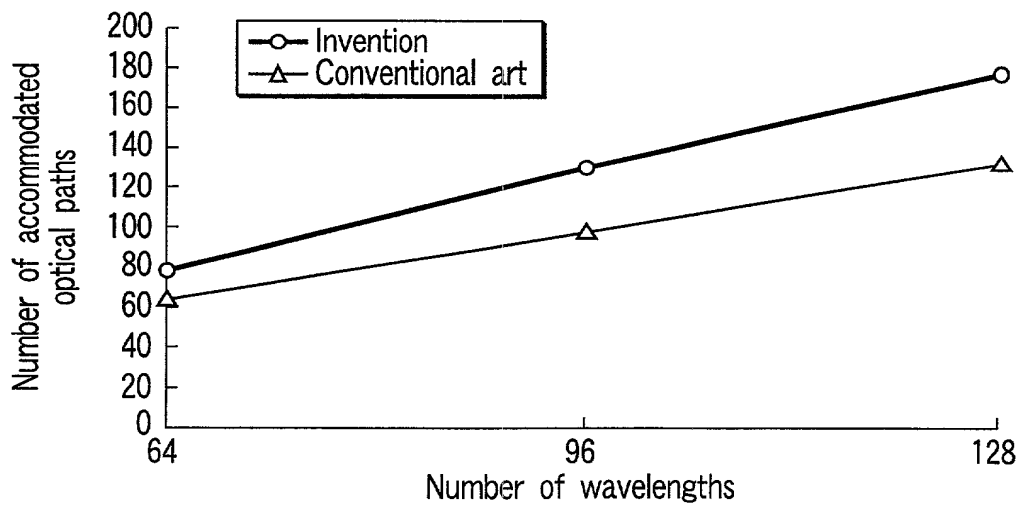


FIG. 27

Schematic view showing that trouble occurs in clockwise optical transmission line between nodes C and D

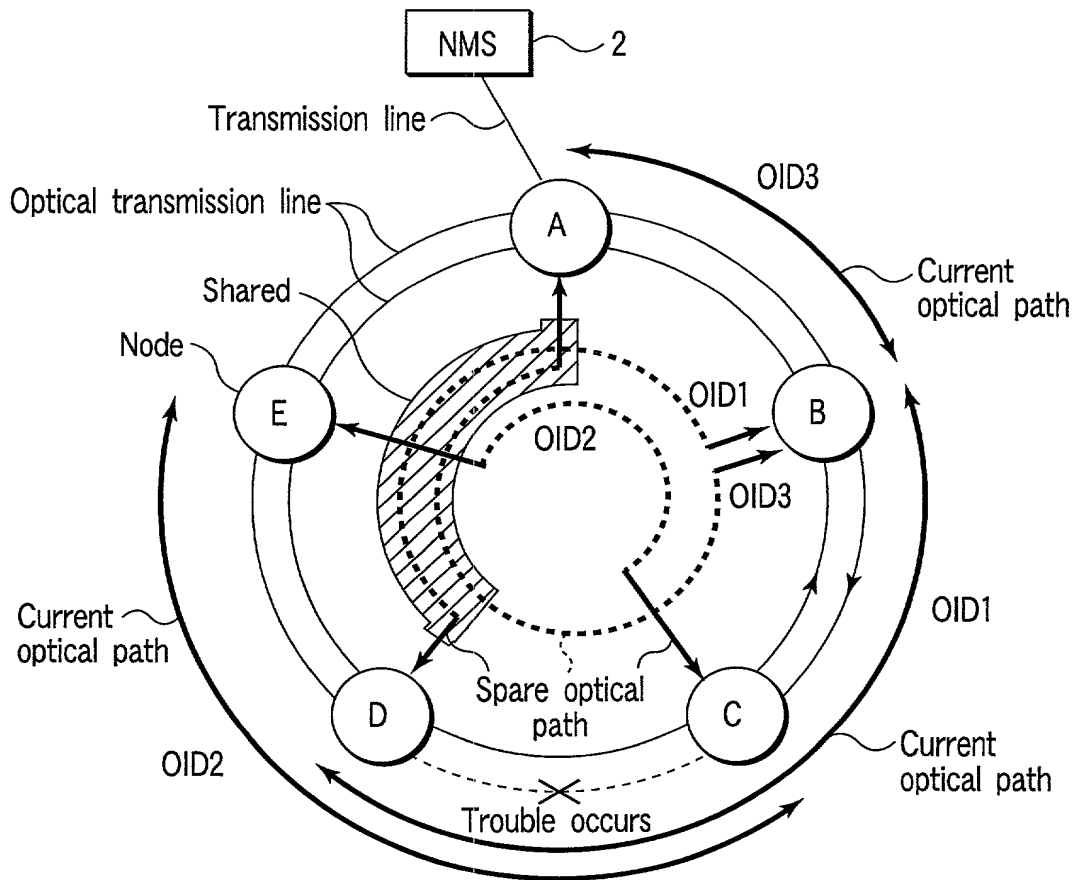


FIG. 28

Flow chart showing recovery operation
executed in WDM ring network system

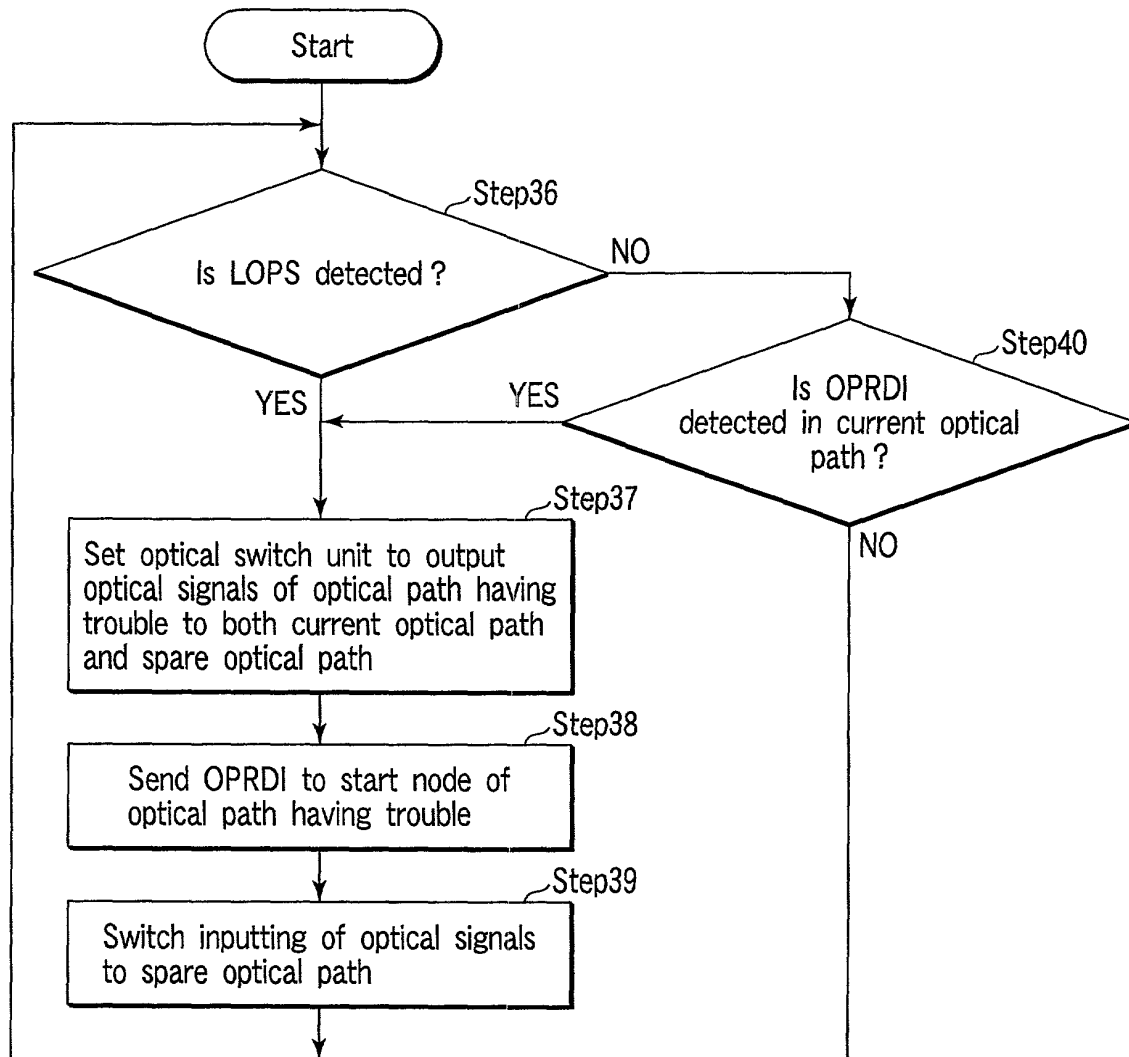


FIG. 29

(Normal state)

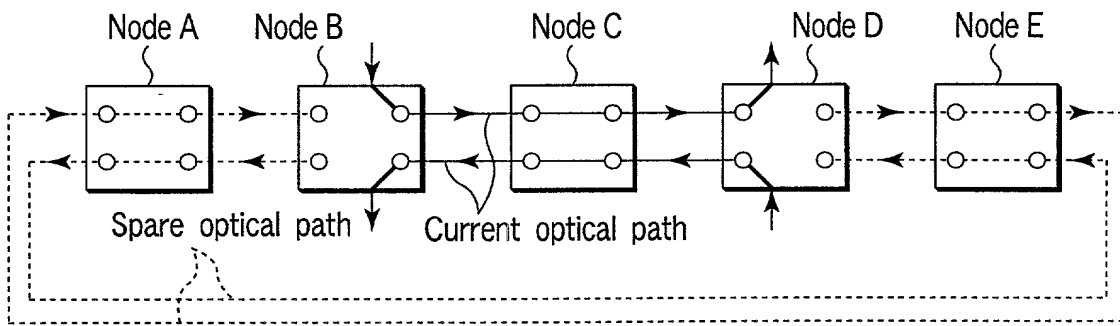


FIG. 30A

(When trouble occurs)

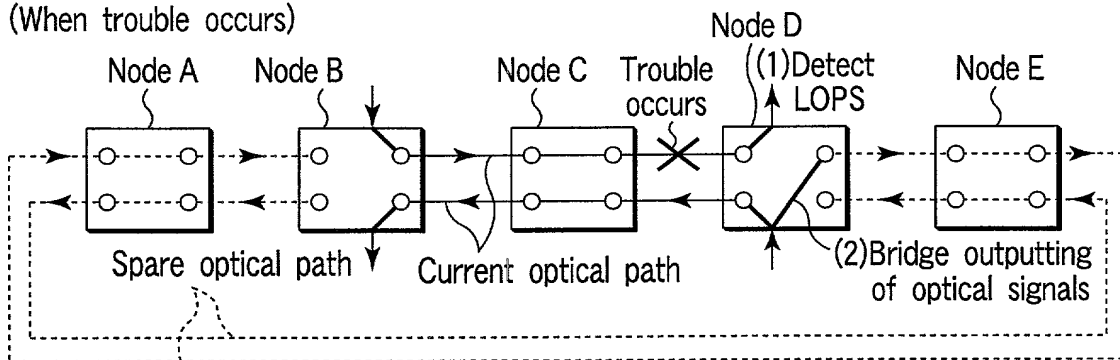


FIG. 30B

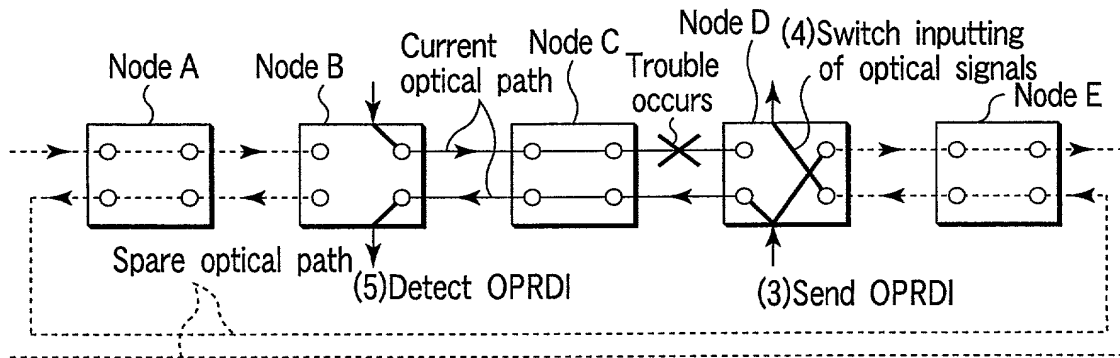


FIG. 30C

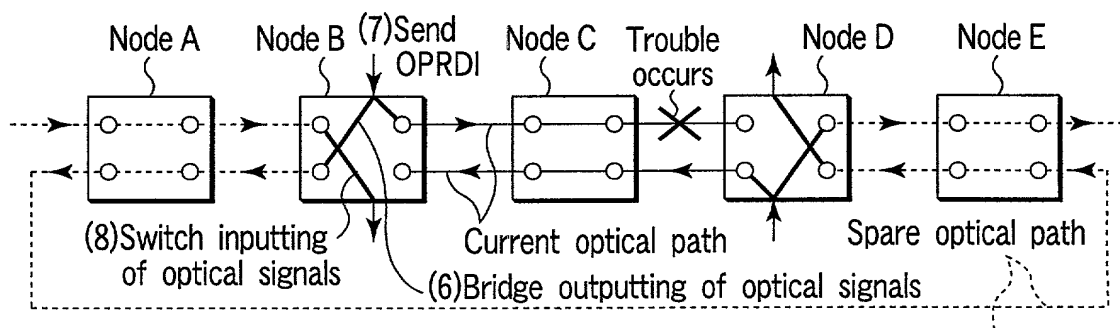


FIG. 30D

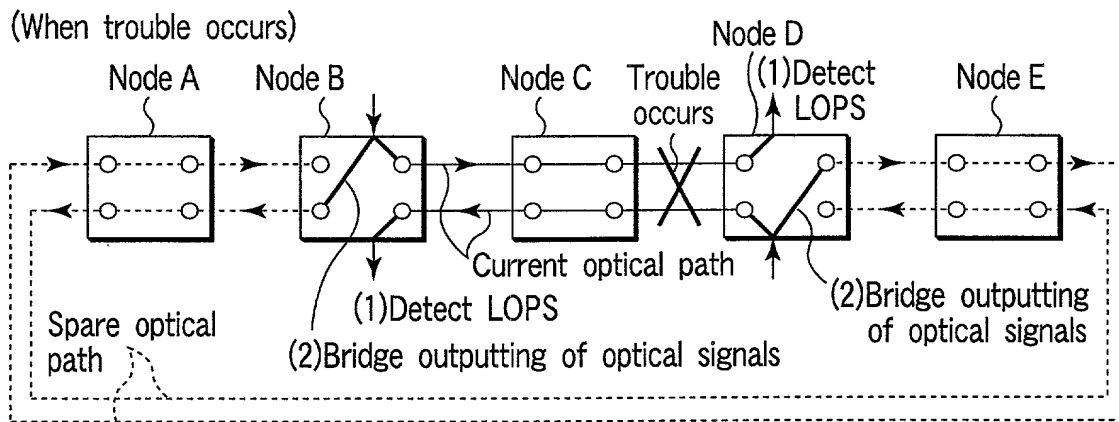


FIG. 31A

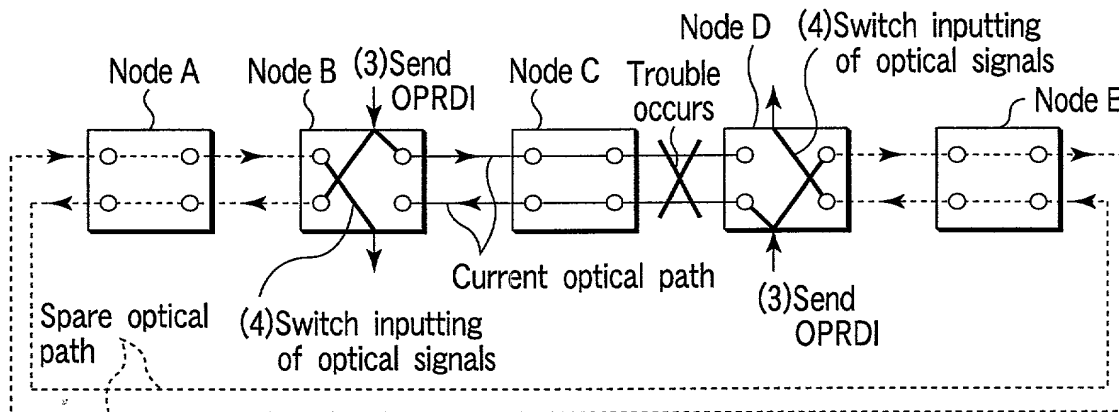


FIG. 31B